Dates of first light and heavy frosts and snow—Continued.

State and station.	First frost.		Snow.	State and station.	First frost.		Snow.
	Light.	Heavy.			Light.	Heavy.	
Washington—Cont'd.				*Washington*—Cont'd.			
Fort Canby			6	Union City			6
Index			16	Vashon			7
Lapush			7	Walla Walla			7
Madrone			7	*West Virginia.*			
Pine Hill			1	Central Station			26
Port Crescent			6	Harpers Ferry			26
Pysht			6	Hinton			27
Seattle			6	Leachtown			25
Silver Creek			6	Martinsburg			26
Snohomish			7	Monarch			26
Sunnyside			7	New Martinsville			26
Tacoma			7	Nuttallburg			26
Tatoosh Island			6	Tannery			26

COLD-WAVE SIGNALS.

The principal cold wave of the month was that of the 28–29th, and the warnings issued in its advance for Florida are stated in the history of high area No. X.

The cold-wave signals displayed during this month are to be interpreted in accordance with Instructions No. 76 of 1894, but the modified instructions, No. 3 of 1895, will go into effect January 1, 1895. The details of the current instructions are given on page 449 of the REVIEW for November.

In accordance with these instructions the following cold-wave signals were ordered during the month of December:

7th, 10.20 a. m., Pierre, Cheyenne, Lander, Denver, Pueblo, Valentine, Omaha, Moorhead, St. Paul, Duluth, Minneapolis, Des Moines, Dubuque, Davenport, Keokuk, St. Louis, Springfield, Mo., Columbia, Mo., Kansas City, Hannibal, and La Crosse.

16th, 10.50 a. m., Dubuque, Duluth, La Crosse, Green Bay, Milwaukee, Chicago, Marquette, Sault Ste. Marie, Grand Haven, Port Huron, and Detroit; p. m., Toledo, Sandusky, Cleveland, Columbus, Cincinnati, Louisville, Buffalo, Rochester, Oswego, Ithaca, Erie, Pittsburg, Parkersburg, and Albany.

21st, 10 a. m., Duluth and Marquette; p. m., Green Bay and Alpena.

22d, a. m., Albany, Northfield, Portland, and Boston.

23d, 8 a. m., Cheyenne and Lander; p. m., Rapid City, Pierre, Huron, and Valentine.

24th, p. m., St. Louis, Springfield, Ill., Chicago, Springfield, Mo., Sault Ste. Marie, Alpena, Grand Haven, and Indianapolis.

25th, a. m., Palestine, Fort Smith, Little Rock, Shreveport, Toledo, Sandusky, Cleveland, Columbus, Cincinnati, Louisville, Nashville, Memphis, Buffalo, Rochester, Oswego, Ithaca, Erie, Pittsburg, Parkersburg, Albany, Northfield, Portland.

26th, 4.30 p. m., Lincoln, Kansas City, Yankton, Omaha, Topeka, Sioux City, Des Moines, Dubuque, Davenport, Keokuk, La Crosse, and Milwaukee; p. m., Green Bay, Chicago, Marquette, and Grand Haven.

27th, 10.30 a. m., Lansing, Columbia, Mo., St. Louis, Springfield, Mo., Hannibal, Springfield, Ill., Cairo, Port Huron, Detroit, and Indianapolis; a. m., Toledo, Sandusky, Cleveland, Columbus, Cincinnati, Louisville, Buffalo, Rochester, Oswego, Erie, Pittsburg, and Atlanta.

27th, p. m., San Antonio, Palestine, Galveston, Corpus Christi, Little Rock, Shreveport, New Orleans, Nashville, Memphis, Knoxville, Chattanooga, Vicksburg, Meridian, Montgomery, Portland, Boston, New London, New Haven, and Lynchburg.

28th, a. m., Mobile and Pensacola.

HUMIDITY.

HUMIDITY.

The quantity of moisture in the atmosphere at any time may be expressed by means of the weight contained in a cubic foot of air. This is usually known as the absolute measure and is equivalent to giving the tension or pressure of the vapor, or the temperature of the dew-point. The mean dew-points for each station of the Weather Bureau, as deduced from observations made at 8 a. m. and 8 p. m., daily, are given in Table I. The vapor pressures and the resulting dew-points, absolute humidities, and relative humidities are all deduced from observations of the wet-bulb thermometer by means of formulæ and tables that were first devised by August and subsequently modified by Regnault, 1845, and Ferrel in 1885, but which are still considered to be open to further improvement. In a general way the dew-points given in Table I are probably slightly lower than they should be, owing to the omission since 1887 of a correction for barometric pressure. There is also an uncertainty in the psychrometric formula which is only just now beginning to be understood, by virtue of which at temperatures below freezing the dew-points and the humidities are higher than they should be. For these reasons the monthly averages of the dew-points and relative humidities are subject to some uncertainty.

AVERAGE HUMIDITY.

The temperature of the wet bulb of the psychrometer is the temperature at which evaporation is going on from a special surface of water on muslin at any moment, but a properly constructed evaporometer may be made to give us the *quantity of water evaporated* from a *similar surface* during any interval of time. Such an evaporometer, therefore, would sum up or integrate the effect of those influences that determine the temperature as given by the wet bulb; from this evaporation the average humidity of the air during any given interval of time may be deduced. Instead of attempting to make a self-registering wet-bulb thermometer we may use the evaporometer as an equivalent. A formula for determining the average vapor tension during an hour was given in 1887, at page 376 of the Treatise on Meteorological Apparatus and Methods (in the section on the use of the evaporometer as an integrating hygrometer), as based on the careful measurements made by Mr. Desmond Fitzgerald and published in the Transactions of the American Society of Civil Engineers, 1886.

It is much to be desired that one or more new series of measurements of evaporation, wind velocity, temperature, and dew-point be made at high and low stations in instrument shelters similar to those used by the Weather Bureau, in order that a general empirical formula may be devised for use with the evaporometer considered as an integrating hygrometer.

WET-BULB OR SENSIBLE TEMPERATURES.

The sensation of heat experienced by the human body and attributed to the atmosphere depends not merely upon the temperature of the air, but especially upon its dryness and the force of the wind. It would seem that the rapid evaporation from the skin in dry, hot weather reduces the temperature of the layer of nerve cells at the surface of the skin. This reduction is not measurable by thermometers which give the temperature of large masses but is appreciated by the minute nerves that end in those microscopic cells. This reduction of temperature, or sensible coolness, is apparently

proportional to the difference between the dry and wet-bulb thermometers, and as shown by the chart accompanying Professor Harrington's memoir on "Sensible Temperatures," June 1, 1894, it amounts on the average to 20° in the month of July in Arizona, Nevada, and Utah and 10° in Kentucky, Indiana, and Ohio.

The resulting sensible temperatures, as shown on his second chart, are simply the so-called average temperatures of the wet-bulb thermometer as obtained by the whirling apparatus used in the shaded shelter, and correspond to the temperatures felt by persons standing in the shade of trees or houses, exposed to a natural breeze of at least 6 miles per hour. The temperature of the wet-bulb thermometer and its depression below the dry bulb are the fundamental data for all investigations into the relation between human physiology and the atmosphere. In order to present a monthly summary of the atmospheric conditions from a hygienic and physiological point of view, Table I*a* has been prepared, showing the maximum, minimum, and mean readings of the wet-bulb thermometer at 8 a. m. and 8 p. m., seventy-fifth meridian time.

PRECIPITATION.

[*In inches and hundredths.*]

The distribution of precipitation for the month of December, 1894, as determined by reports from about 2,500 stations, is exhibited on Chart III. The numerical details are given in Tables I, II, and III; the first of these also gives the average departures from the normal for each district, whereas the average departure for each State is given in Table XII for each State Weather Service. Unless otherwise stated, the snow or hail is understood to be melted and added to the rainfall.

DIURNAL VARIATION.

Table IV*b* gives the total precipitation for each hour of seventy-fifth meridian time, as deduced from self-registering gauges kept at about 43 regular stations of the Weather Bureau; of these 37 are float gauges and 6 are weighing gauges.

NORMAL PRECIPITATION FOR DECEMBER.

The normal precipitation for December is shown on Chart IX of the Atlas of Bulletin C, entitled "Rainfall and Snow of the United States, Compiled to the End of 1891, with Annual, Seasonal, Monthly, and other Charts," by Mark W. Harrington, Chief of the Weather Bureau, Washington, 1894. From this Chart it appears that the region of greatest rainfall in December on the Pacific coast is the northwest corner of Washington, with a normal of 14 inches; on the Atlantic coast it is at Cape Hatteras, with a normal of 5 inches, which also extends over portions of northern Georgia, Alabama, Mississippi, and Louisiana. Less than 1 inch is to be expected over any portion of the eastern and northern Rocky Mountain slope.

PRECIPITATION FOR CURRENT MONTH.

The precipitation for the current December was heaviest in the northwest portion of California and southwest corner of Oregon. The snowfall was also remarkably heavy on the upper portions of the Sierra and Coast ranges, as shown in detail in a following section.

CURRENT DEPARTURES FROM NORMAL PRECIPITATION.

The precipitation for December was deficient over the whole of the United States, except a few small areas, i. e., California and Nevada, Lake Superior, eastern Kentucky and Tennessee, and thence to central New England.

The principal departures from the normal at Weather Bureau stations were as follows:

Excesses: Red Bluff, 5.7; Sacramento, 4.6; Eureka, 4.2; San Francisco, 3.8; Fresno, 2.6.

Deficits: Fort Canby, 5.5; Olympia, 5.0; Portland, Oreg., 4.8; Astoria, 4.3; Galveston, 3.9; Charleston and Savannah, 3.2.

Considered by districts, the precipitation for December, 1894, when compared with the normal for the month, furnishes the departures given in Table I, as expressed in inches. By dividing those departures by the normal precipitation for December we obtain the following corresponding percentages (precipitation is in excess when the percentage of the normal exceeds 100):

Above the normal: New England, 123; middle Atlantic, 103; Ohio Valley and Tennessee, 108; lower Lake, 134; southern plateau, 140; middle plateau, 122; middle Pacific, 181; southern Pacific, 133.

Normal: Middle slope, 0.00.

Below the normal: South Atlantic, 56; Key West, 14; east Gulf, 77; west Gulf, 57; upper Lake, 77; North Dakota (extreme northwest), 47; upper Mississippi, 85; Missouri Valley, 64; northern slope, 60; southern slope (Abilene), 35; northern plateau, 47; north Pacific, 69.

For certain voluntary stations of rather long periods of observation the normal and extreme monthly precipitations and the departures are shown in detail in Table X*b*, which is now placed among the meteorological tables instead of being inserted in the text as heretofore.

YEARS OF GREATEST PRECIPITATION FOR DECEMBER.

The precipitation for the current month was the greatest on record for the month of December at regular Weather Bureau stations, as shown in the following table:

Station.	Current precipitation.		Previous maximum.	
	Amount.	Departure.	Amount.	Year.
Fresno, Cal.	4.09	+2.6	3.99	1891
Nantucket, Mass.	5.83	+2.4	4.93	1886

YEARS OF LEAST PRECIPITATION FOR DECEMBER.

The precipitation for the current month was the least on record for the month of December at regular Weather Bureau stations, as shown in the following table:

Station.	Current precipitation.		Previous minimum.	
	Amount.	Departure.	Amount.	Year.
Key West, Fla.	1.26	— 1.6	0.27	1874
San Antonio, Tex.	0.04	— 1.7	0.27	1889
Dubuque, Iowa.	0.35	— 1.6	0.52	1876
North Platte, Nebr.	T.	— 0.7	0.03	1890
Valentine, Nebr.	0.05	— 0.6	0.10	1886
Pierre, S. Dak.	0.08	— 0.4	0.08	*
Bismarck, N. Dak.	0.06	— 0.7	0.06	1881
Walla Walla, Wash.	0.80	— 1.7	0.94	1890
Fort Canby, Wash.	1.63	— 3.7	3.07	1885

*Frequently.

ACCUMULATED PRECIPITATION.

The total accumulated monthly departures from normal precipitation from the beginning of the year to the end of the current month are given in the second column of the fol-